Instructor:	Frank Secretain
Course:	Math 101
Date:	September 25, 2024
Assessment:	Test 1
Time allowed:	110 minutes
Devices allowed:	Pencil, pen, eraser, calculator
Notes from instructor:	Be neat. Show your work where needed. Box final answers.
Marks allocated:	5 questions worth 20 marks
Percentage of final grade:	20% of final grade

Formula Sheet

Order of Operations

$$ac + bc = c(a + b)$$

exponents

$$a^n a^m = a^{n+m}$$

$$(a^n)^m = a^{nm}$$

$$(ab)^n = a^n b^n$$

$$a^0 = 1$$

$$a^{-n} = \frac{1}{a^n}$$

radicals

$$a^{\frac{n}{m}} = \sqrt[m]{a^n}$$

Relative Velocity

$$\vec{v}_{\frac{A}{C}} = \vec{v}_{\frac{A}{B}} + \vec{v}_{\frac{B}{C}}$$

Linear equations (Cramer's rule)

$$x_i = \frac{det(A_i)}{det(A)}$$

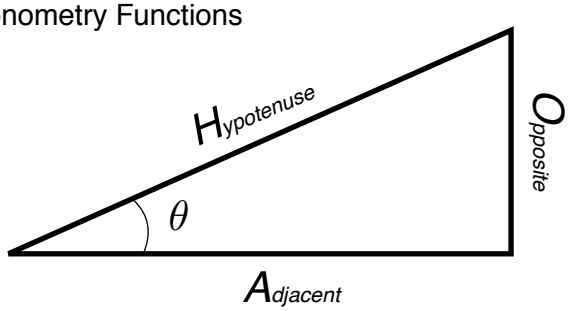
Forms of a 2nd order polynomial

$$y = ax^2 + bx + c$$

$$y = a(x - h)^2 + k$$

$$y = (x - m)(x - n)$$

Trigonometry Functions



$$sin(\theta) = \frac{O}{H} \qquad sin^{-1}\left(\frac{O}{H}\right) = \theta$$

$$cos(\theta) = \frac{A}{H} \qquad cos^{-1}\left(\frac{A}{H}\right) = \theta$$

$$tan(\theta) = \frac{O}{A} \qquad tan^{-1}\left(\frac{O}{A}\right) = \theta$$

Pythagoras Theorem

$$H^2 = O^2 + A^2$$

Unit Conversions

angles

$$2\pi = 6.28 \text{ rad} = 360^o$$

mass

$$1 \text{ kg} = 2.2 \text{ lbs.}$$

lengths

$$1 \text{ mile} = 1.6 \text{ km}$$

$$1 \text{ inch} = 2.54 \text{ cm}$$

$$1 \text{ m} = 3.3 \text{ ft}$$

volumes

$$1 \text{ gallon} = 3.78 \text{ Litres}$$

(4 marks) Match the “type of number” with the best “example number”. Draw a line to match the “type of number” to the “example number” to indicate your answer.

irrational	0
integer	$-\sqrt{1}$
rational	-2.1
whole	$\sqrt{3}$

(3 marks) Determine

a) the total number of significant digits and
b) the number of decimal places to the least significant digit
c) re-write the number in scientific notation

for the following number:

0.020310

a) significant digits = _____

b) decimal places = _____

c) scientific notation = _____

(3 marks) Solve the each expression and keep the correct number of significant digits.

160+12.183

(13.0)(0.02310)

212.4+(290)(3.008492)

(5 marks) Given the standard unit conversion table on the formula sheet (1st page), convert each of the numbers to the stated units.

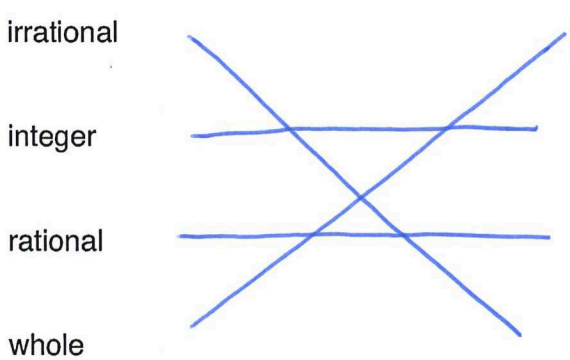
$$3.2\ \frac{\text{kg}}{\text{second}} \rightarrow \frac{\text{lbs.}}{\text{minute}}$$

$$0.0452\ \frac{\text{radians}}{\text{inch}} \rightarrow \frac{\text{degrees}}{\text{m}}$$

$$0.00873\ \frac{\text{gallon}^2}{\text{minute}} \rightarrow \frac{\text{Litres}^2}{\text{day}}$$

(5 marks) You run 730 m East, 250 m at 65^0 North of East and 120 m at 50^0 West of North. How far are you from where you started?

(4 marks) Match the "type of number" with the best "example number". Draw a line to match the "type of number" to the "example number" to indicate your answer.



0 = 0

$-\sqrt{1}$ = -1

-2.1 = -2.1

$\sqrt{3}$ = 1.732....

(3 marks) Determine

a) the total number of significant digits and
b) the number of decimal places to the least significant digit
c) re-write the number in scientific notation

for the following number:

0.020310

-5
+6

a) significant digits = 5

b) decimal places = +6

c) scientific notation = 2.0310×10^{-2}

(3 marks) Solve the each expression and keep the correct number of significant digits.

160+12.183 = 172.183 = 170

-1 +3 -1

(13.0)(0.02310) = 0.3003 = 0.300

3 4

$212.4+(290)(3.008492)$ (2 sig figs, 7 sig figs)

$= 212.4 + 872.46268$ (+1, −1)

$= 1084.86268$ (−1)

$= \boxed{1080}$

(5 marks) Given the standard unit conversion table on the formula sheet (1st page), convert each of the numbers to the stated units.

$$3.2 \ \frac{\text{kg}}{\text{second}} \rightarrow \frac{\text{lbs.}}{\text{minute}}$$

$$3.2 \ \frac{\text{kg}}{\text{sec}} \left(\frac{2.2 \text{ lbs}}{1 \text{ kg}}\right)\left(\frac{60 \text{ sec}}{1 \text{ min}}\right) = 422.4 \ \frac{\text{lbs}}{\text{min}} = \boxed{420 \ \frac{\text{lbs}}{\text{min}}}$$

$$0.0452 \ \frac{\text{radians}}{\text{inch}} \rightarrow \frac{\text{degrees}}{\text{m}}$$

$$0.0452 \ \frac{\text{rad}}{\text{inch}} \left(\frac{360^\circ}{2\pi \text{ rad}}\right)\left(\frac{1 \text{ inch}}{2.54 \text{ cm}}\right)\left(\frac{100 \text{ cm}}{1 \text{ m}}\right) = 101.959 \ \frac{\text{deg}}{\text{m}}$$

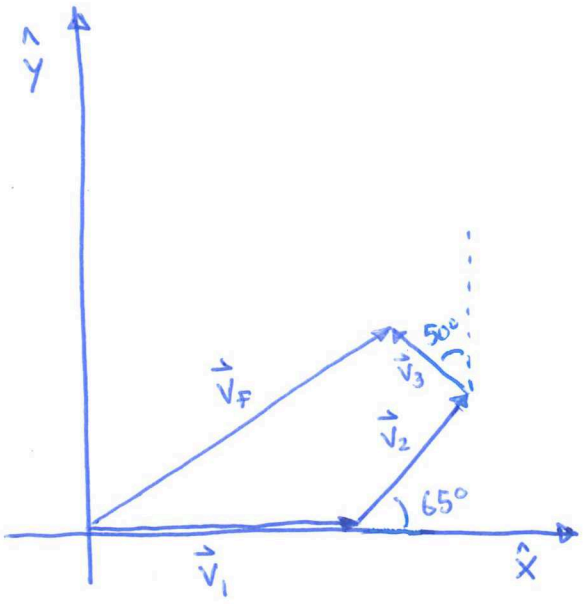
$$= \boxed{102 \ \frac{\text{deg}}{\text{m}}}$$

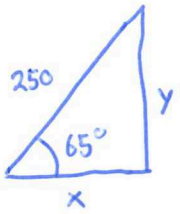
$$0.00873 \ \frac{\text{gallon}^2}{\text{minute}} \rightarrow \frac{\text{Litres}^2}{\text{day}}$$

$$0.00873 \ \frac{\text{gal}^2}{\text{min}} \left(\frac{3.78 \text{ L}}{1 \text{ gal}}\right)\left(\frac{3.78 \text{ L}}{1 \text{ gal}}\right)\left(\frac{60 \text{ min}}{1 \text{ hour}}\right)\left(\frac{24 \text{ hour}}{1 \text{ day}}\right) = 179.62 \ \frac{\text{L}^2}{\text{day}}$$

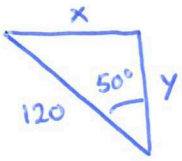
$$= \boxed{1.80 \times 10^2 \ \frac{\text{L}^2}{\text{day}}}$$

(5 marks) You run 730 m East, 250 m at 65^0 North of East and 120 m at 50^0 West of North. How far are you from where you started?





$x = 250 \cos(65)$
$= 105.655$
$y = 250 \sin(65)$
$= 226.577$



$x = 120 \sin(50)$
$= 91.925$
$y = 120 \cos(50)$
$= 77.135$

$\vec{V}_1 + \vec{V}_2 + \vec{V}_3 = \vec{V}_F$

$\vec{V}_1 = 730\,\hat{x} + 0\,\hat{y}$

$\vec{V}_2 = 105.655\,\hat{x} + 226.577\,\hat{y}$

$\vec{V}_3 = -91.925\,\hat{x} + 77.135\,\hat{y}$

$\vec{V}_F = 743.73\,\hat{x} + 303.712\,\hat{y}$

$|V_F| = \sqrt{(743.73)^2 + (303.712)^2}$

$= 803.353$

$= \boxed{8.0 \times 10^2 \text{ m}}$